Programme's After Market Services
NHP–4 Series Transceivers

Disassembly & Troubleshooting

Issue 1 04/99

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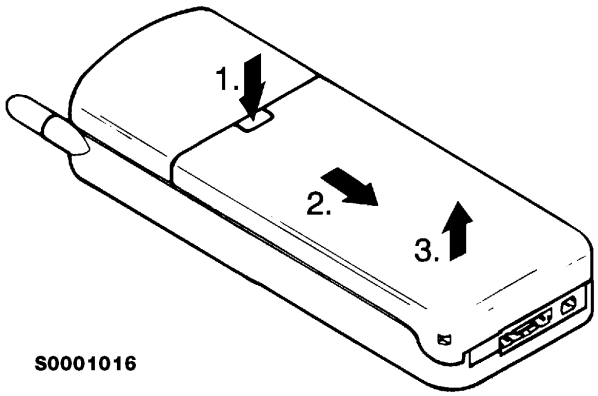
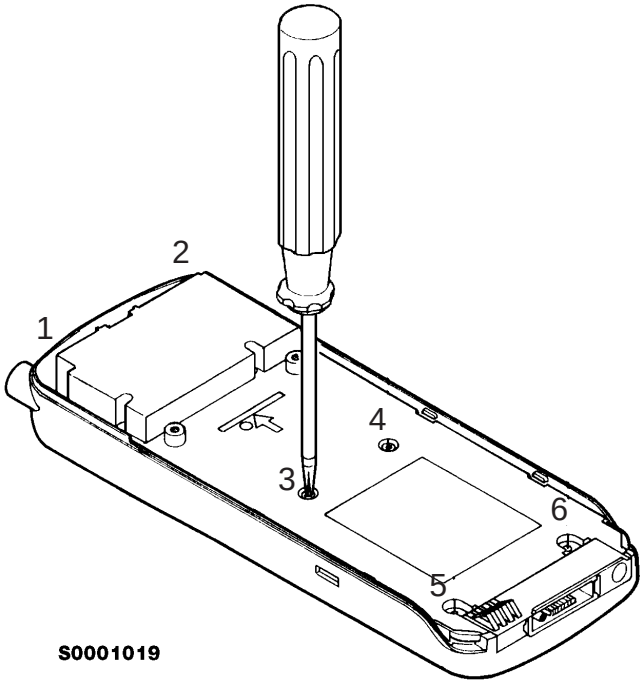
Disassembly Instructions



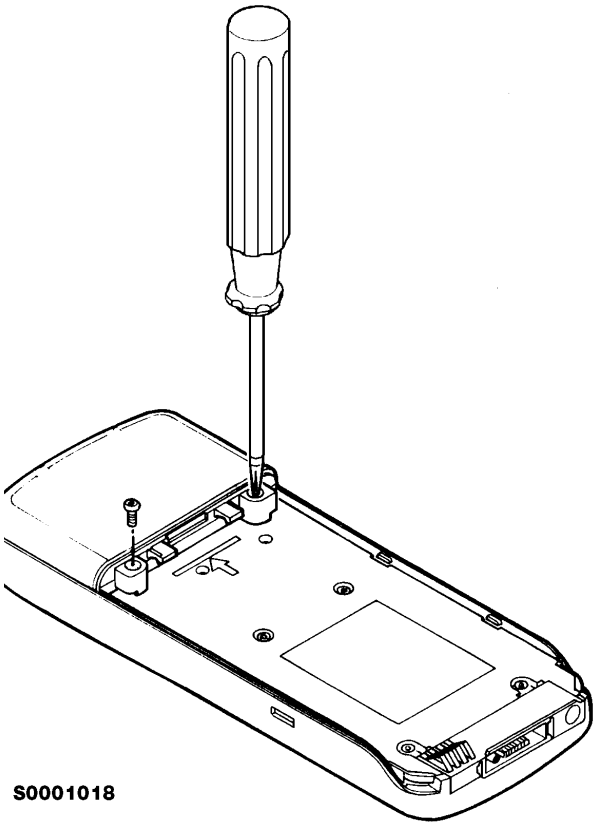
S0001016

Remove the battery.

Now remove two back cover screws and remove the back cover by lifting it away.

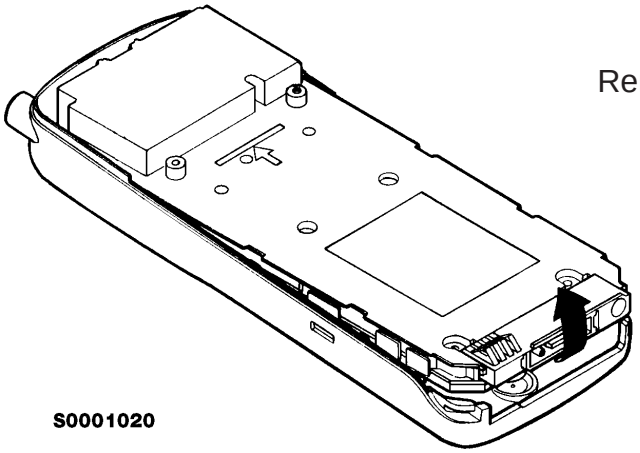


S0001019



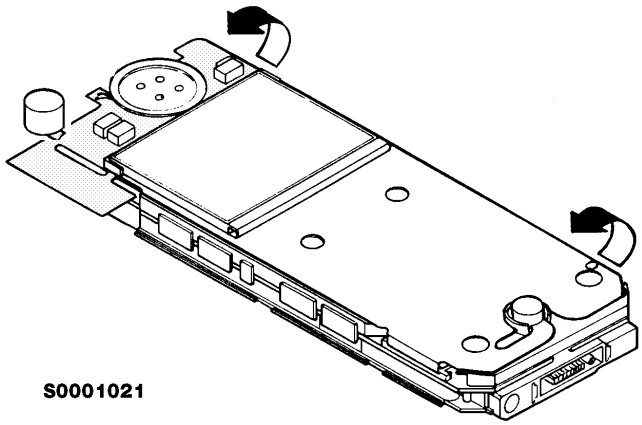
S0001018

Then remove six chassis screws.



S0001020

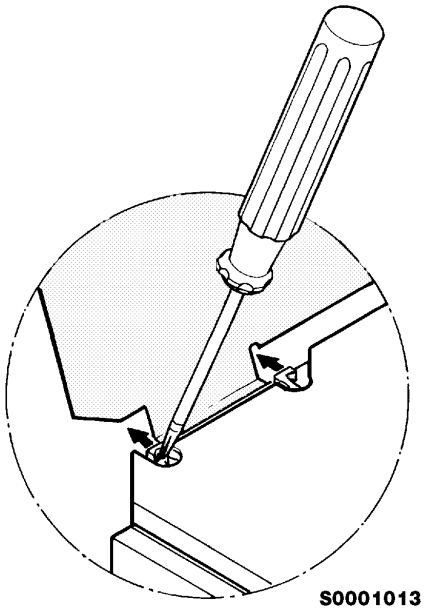
Remove the chassis by lifting.



S0001021

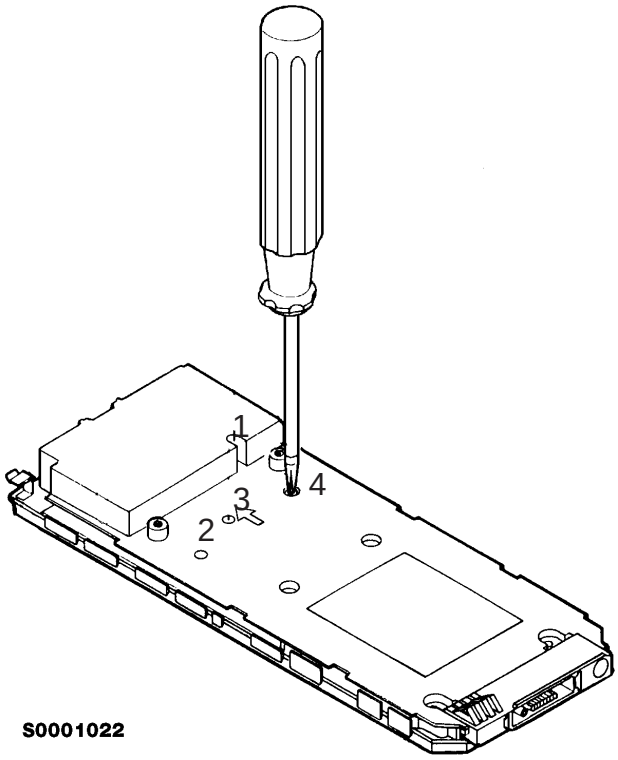
Turn around the chassis and open the display module a little.

Open the display module connector by pressing both sides of connector and slide off the display module cable.

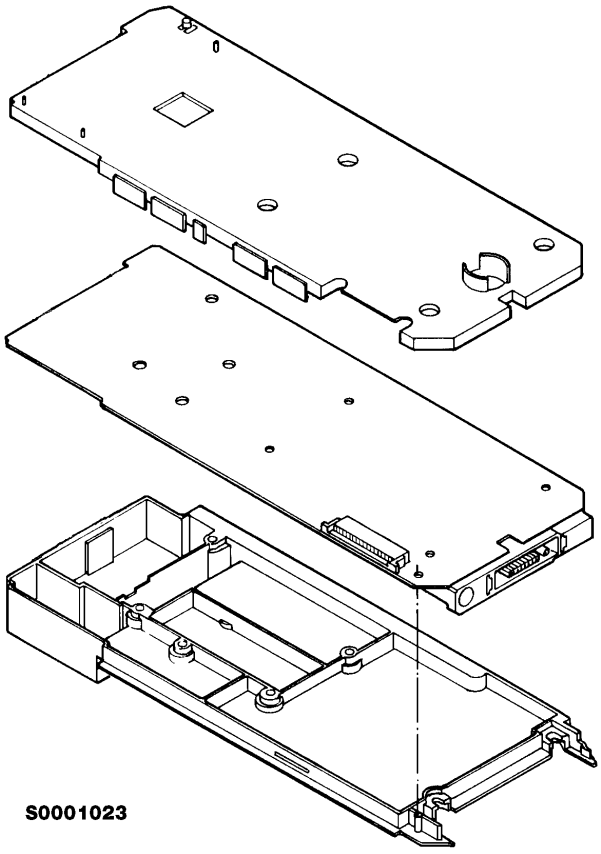


S0001013

Turn chassis again and remove four chassis screws.



S0001022


S0001023

Remove the plastic shield and throw it away (it is disposable).

Now you can separate the system module from the bottom shield by lifting it away.

HD891 Baseband Troubleshooting

Overview of baseband troubleshooting

Baseband oriented failures are typically discovered during flash and alignment. Before programming the flash memory, the phone is started in minimum mode and current consumption is measured. If current consumption is within acceptable limits and the MCU software version is successfully read via MBUS, the flash is then programmed. If flash programming fails, the phone is taken off line where MCU self tests will be performed at a separate troubleshooting station. During MCU self tests, address and data lines to the major components of the baseband are tested. Each test returns the number of the test and the results (OK / failed). Test information is also stored to a phone test file, which can be available for later use.

If the phone can be flashed and the DSP downloaded, the baseband is generally functioning properly. If not, referring to the test file of the phone will aid in the detection of defective components or connections.

In case of current consumption/MBUS registration failure, more specific measurements of voltages, clocking signals and states of reset signals must be evaluated.

General

The purpose of this document is to define a method by which failures in the baseband of the phone can be detected and corrected. Each section of the circuit shall be described in adequate detail such that the reader may be able to verify whether each section is functioning properly, and if not, where the problem resides.

Required servicing equipment:

- Service software
- Power supply (1.0 A)
- Digital multimeter
- Oscilloscope
- Modular cable
- RS232/MBUS adapter
- Soldering iron and related tools.

General Failures

The most common baseband failures detected in production will likely be the following:

1) The phone will not flash (phone seems dead).
2) The DSP will not download.
3) Phone will power up in minimum mode and then power down.

Other Possible Failures

Less likely failures may be:

1) Power circuit
2) Reset logic
3) Clocks
4) Charging circuit
5) BTEMP
6) BTYPE
7) Power to differential audio circuit and headset (VAHS)
8) RFTEMP
9) Watchdog circuit

Troubleshooting Specific Sections

Below describes in detail each of the main circuit sections. Circuit verification and troubleshooting can be performed by verifying the signals and voltages described in each section.

Power

3 Volt Switching Power Supply

The MAX887 (N704) is the 3V power supply for the baseband. Pin 8 should have battery power at all times (unless, of course, the battery is not installed), and pin 7 is the output which is approximately 3.15V. This output by nature will be very noisy. However, it is filtered by an LC circuit and a rectifying diode which gives a fairly clean supply. This should be evident by probing the signal labeled 3VD.

Pin 1 is the control pin for the power supply. The supply is active when this pin is at a logic high (in this case 2.5V), and powers down when it is at a logic low. It is connected directly to the watchdog circuit, which controls whether the power supply is on or off.

Pin 6 is the sync pin, which allows the supply to switch in sync with the clock driving it. The clock frequency should be 307kHz, but should still function with no clock at all.

3V Power Distribution

Check the MCU (D706) supply voltage 3VD (3.15V) on pins 5 and 42, and VREF (3.15V) pin 60. Check voltages of MCU related memory components: FLASH (D702) pins 30, 31 and 11; RAM (D708) pin 7; and EEPROM (D703) pin 8.

Check the ASIC (D705) supply voltage 3VD (3.15V) on pins 13, 22, 27, 44, 60, 65, 74, 88,103, 109, 117, 132, 146, 151, 161, and 176.

Check the,DSP (D707) supply voltage 3VD (3.15V) on pins 8, 11, 36, 39, 49, 64, 76, 87 and 90. 3VD (3.15V) is also fed to the DSP RAM (D709) to pin 11 and 33.

Check the CDRFI (N703) supply voltage 3VD (3.15V) on pins 32, 33, 60, 62, 2, 6, 8 and 19.

Check the supply voltages of the audio CODEC (N706). 3VA (3.15V) is fed to pins 41 and 42. 3VD (3.15V) is connected to pin 18.

4.8 Volt Linear Regulator

The 4.8 volt linear regulator (N707) supplies power the the flex circuit board (UIF), the differential audio circuit at the output of the CODEC and leading to the bottom connector, and the headset accessory.

Pin 6 is the power input to the regulator and should be connected to battery voltage. Pin 1 is an on/off switch. When this pin is high the regulator is on, and when low it is off. The output is at pin 4 and is labeled 5VD.

Reset Logic

XPWR_RESET is the main reset for the entire baseband. It is generated at pin 7 of N705 and is associated with a RC delay at pins 1 and 5 to give the circuit time to power up before letting the reset go inactive. With the battery installed, pins 2 and 6 of N705 must always be at 2.5 volts (these pins are connected to the 2.5 volt reference diode).

XPWR_RESET drives only the CDSB ASIC at pin 2. When the ASIC is fully active it then drives the reset (XSYS_RESET, pin 168) to the MCU (pin 10) and the DSP (pin 69). This reset is asserted whenever the battery is plugged in, or when the power–on button is pressed. All resets are active low. When the phone is up and running, all resets should be high.

Clocks

The MCU (D700), DSP(D707), and ASIC(D705) must all have an active clock driving them in order to function. The clocks are fundamentally derived from the VCTCXO (G100) in the RF section. It emits a 15.36MHz sinusoid which drives the CDRFI (N703, pin 1). The same RF section also emits a 9.83MHz sinusoid which drives the CDRFI at pin 3. These signals MUST be present in order for the phone to function.

The CDRFI then generates the squarewave version of these two sinusoids and sends them to the ASIC (15.36MHz at pin147 and 9.83MHz at pin162).

Pin 104 of the ASIC drives the MCU clock (MCU_CLK) at MCU pin 69, and drives the DSP clock (DSP_CLK) at DSP pin 68.

Watchdog

The watchdog circuit is used to monitor whether the MCU software is functioning properly. The watchdog circuit will shut down the phone if it is not updated regularly by the MCU. Currently, the watchdog will expire and shut down the phone 9 seconds after the power–on button is pressed. Therefore, if the MCU fails to begin resetting the watchdog before the 9 seconds has elapsed, the phone will be shut down.

The MCU software is written such that it resets the watchdog once every 2.5 seconds. If the phone remains on (hence, the watchdog is being updated), it is believed that the MCU software is functioning properly.

The MCU drives the watchdog pulse from pin 43. It is active high. The signal drives an inverter (D701) which then drives the watchdog circuit. By probing the MCU pin and pin 4 of D701, the watchdog pulse can be verified. An AC version of this pulse can be seen at pin 3 of comparator N702. Pins 2 and 5 of N702 should always be at 2.5V.

The behavior of the RC delay can be monitored at pin 1 of N702. The voltage at this pin should rise slowly, and then instantly drop to a low voltage. It will slowly rise again and repeat the process. The signal will drop in conjunction with watchdog pulse. If the voltage rises above 2.5 volts, pin 7 of N702 will go low and shut down the 3V power supply.

The watchdog can be reset by the MCU pulse (as mentioned above) OR when the power–on button is pressed (XPWRON), or when the battery is plugged in, or when a charger is plugged in.

Charging Circuit

The charging circuit is used to control the current transfer from the charger to the battery. When the CHAR_PWM signal from pin 76 of the MCU is high, current is flowing from the charger to the battery via V705. When this signal is low, charging is stopped. When a battery becomes fully charged, CHAR_PWM will pulse 2 times per second to maintain battery voltage. The MCU detects when a charger is plugged in when the CHAR_INT signal goes high (3V). This signal interrupts the ASIC, which then interrupts the MCU. The charger voltage is approximately 12V when CHAR_PWM is low, and about 7.5 to 8.5V when it is high.

The MCU monitors the battery voltage through the BATT_ADC signal. This signal should be approximately 1/3 of the actual battery voltage.

The MCU monitors the charger voltage through the CHAR_ADC signal. This signal should be approximately 1/8 of the actual charger voltage.

MCU

Address and Data Lines

If the phone successfully flashes, then it can generally be concluded that the MCU if functioning properly. If it does not flash, the phone must be

further tested to determine whether the address and data lines are connected and functioning properly by performing read and write cycles to various parts of the phone. This will be done at a separate test station.

MBUS

If the MBUS line is not working, the phone can not be flashed. MBUS signals must appear at MCU pins 66 (TXD) and 67 (RXD). For TXD they must also appear at pin 2 of V711 and pin 2 of V712. For RXD the signals must appear at pins 1 and 4 of D706.

BTEMP, BTYPE, RFTEMP1, RFTEMP2, VAHS

The circuits for BTEMP and BTYPE can be verified by checking whether the components are connected as described in the schematic. In MCU inputs for these signals are on pins 55 and 57, respectively, and should maintain a constant DC value. If either of these are not functioning properly, it may be that the components were placed incorrectly, or messy solder has shorted out some of the components.

RFTEMP1 and RFTEMP2 are multiplexed into one MCU pin (56). The switch (D704) is controlled by MCU pins 44 and 45. When one of these pins goes high, the corresponding switch is closed, resulting in a short circuit from the input to the output. This can be verified by monitoring the input and output of a switch with a voltmeter, and observing that the input voltage is equal to the output voltage

VAHS is turned on by MCU pin 74 via V710 and V715. It should be about 4.7V when on, and high impedance when off.

DSP

CODEC & Differential Amplifier

The CODEC (N706) is the audio interface to the user. It has two main clocks, MCLK and CCLK. MCLK must be continuously on during linear speech coding or decoding. CCLK is used to clock serial data to the control registers.

The main microphone (hand portable mode) drives pins 33 and 34. The external microphone (XMIC) is used for accessories only, and drives pin 31.

The earpiece (internal speaker) in driven differentially by pins 5 and 6. Receive audio for the accessories is driven from pins 2 and 3 into a differential amplifier. This circuit is different from the usual accessory/CODEC design. The opamp (N708) is powered by VAHS which is switched on by the MCU when an accessory is detected.

Pin 5 must be at 4.7V. Pin 4 must have a DC value of about 2.5V, and the hot node of the 2.5 volt shunt regulator must also be at 2.5V.

Failures

Current consumption failures

Usually common to these types of failures is that phone can not be programmed or tested via MBUS. The most common failure is that phone takes normal current during startup and after a few seconds all circuits are powered down. The reason for this failure could be in power, clock or reset distribution of the phone. In cases where the phone does not take current at all, or the phone takes all available current, the reason is usually a defective 3V power supply (N704) or bad soldering (short or open) around it.

Phone takes all available current

If phone takes all available current, the problem is likely caused by a shorted component. Verify correct operation of the 3V power supply (N704). Check solder joints, and the components around it and bottom connector (X700).

Phone does not take current at all

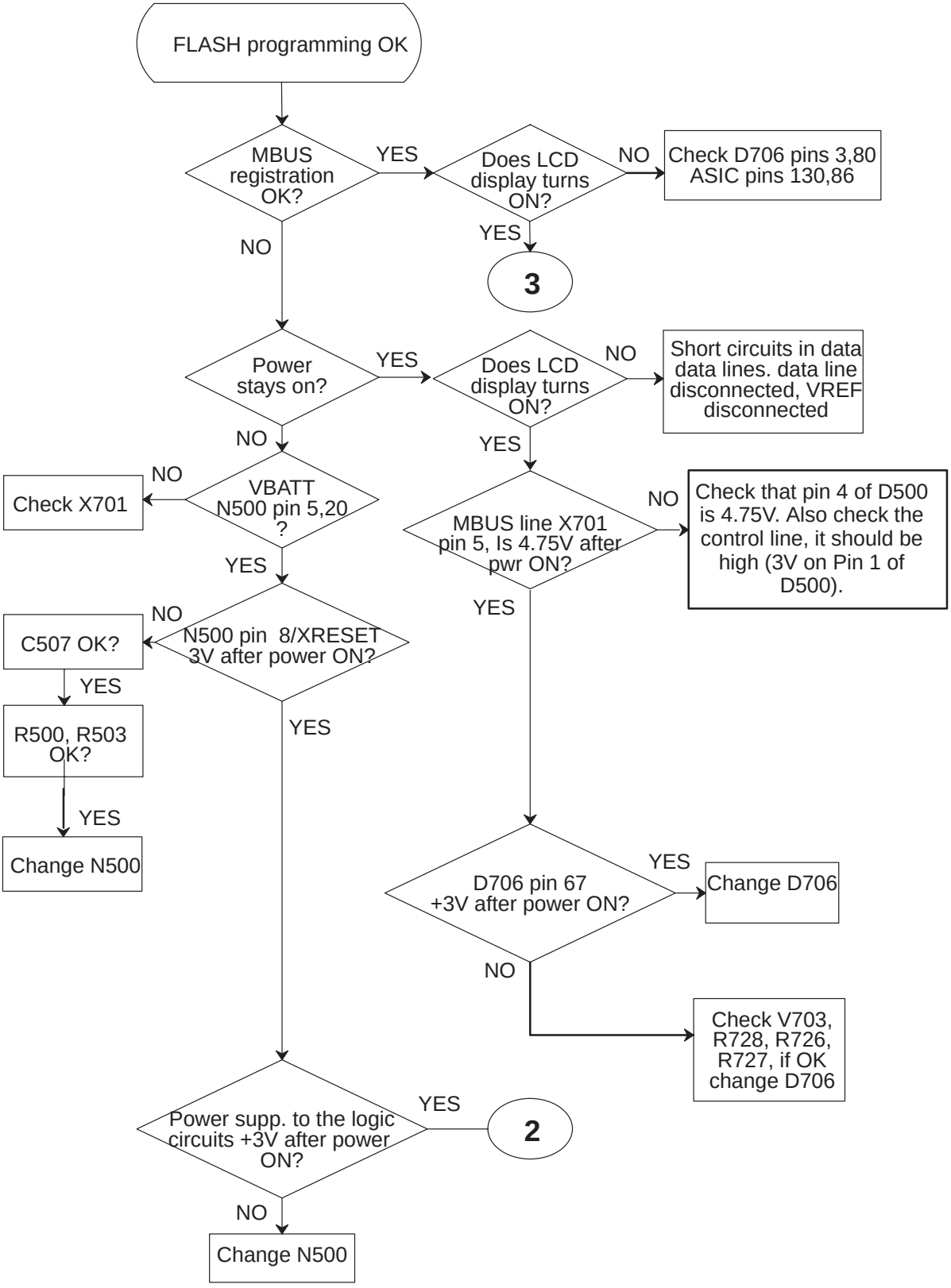
If phone does not take current at all, verify correct operation of the 3V power supply (N704). If pin 1 is always being held low, check the watchdog circuit for proper operation.

Current consumption OK during power–up, then fail

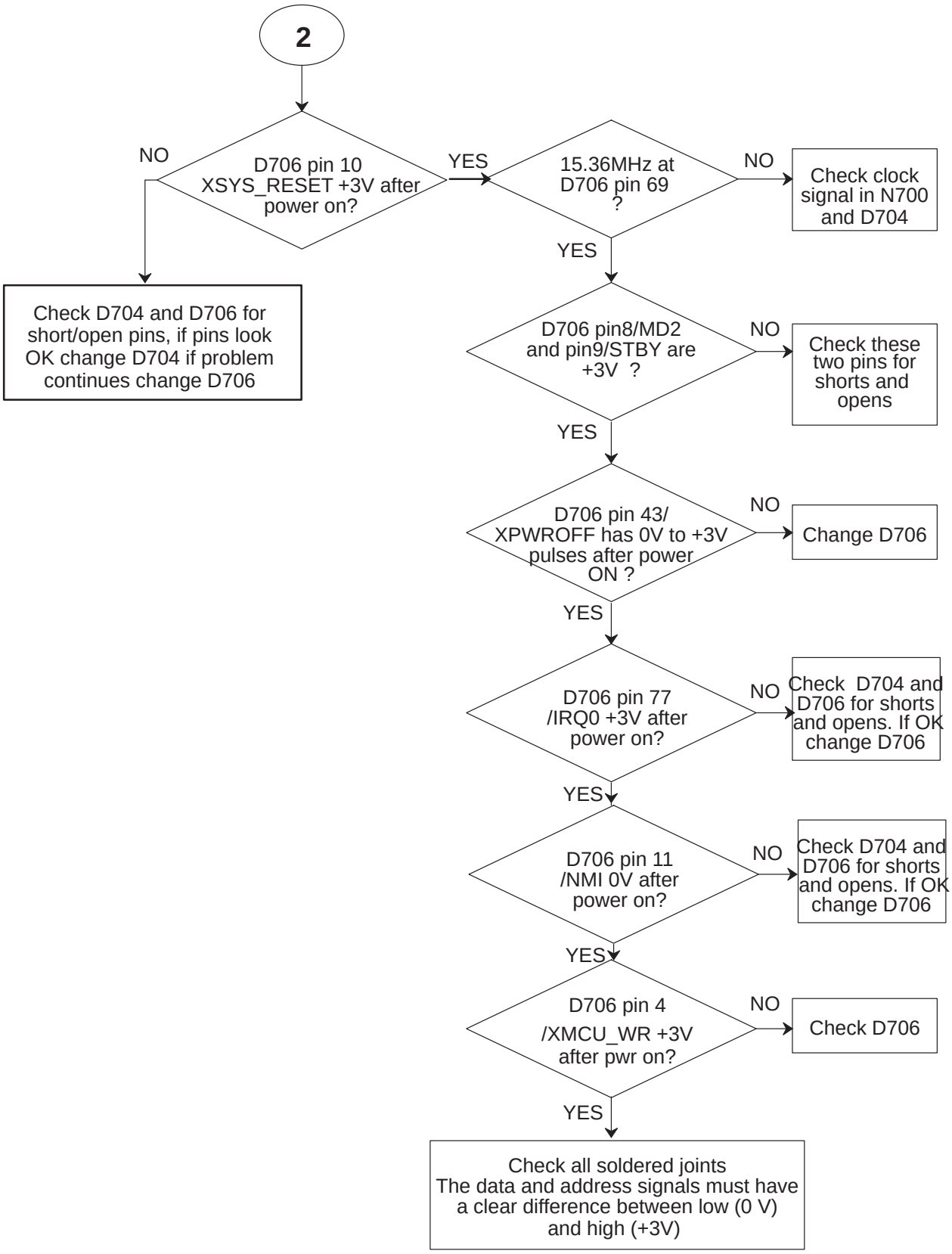
A more common failure in current consumption is that the phone seems to start normally, then after few seconds all circuits are powered down. The power–down is likely caused by the absence of the MCU watchdog pulse.

Verify that the 3V power distribution to all baseband main components is correct. Then check that the clocks are operating. If everything seems OK, check that the RESET logic is operating properly.

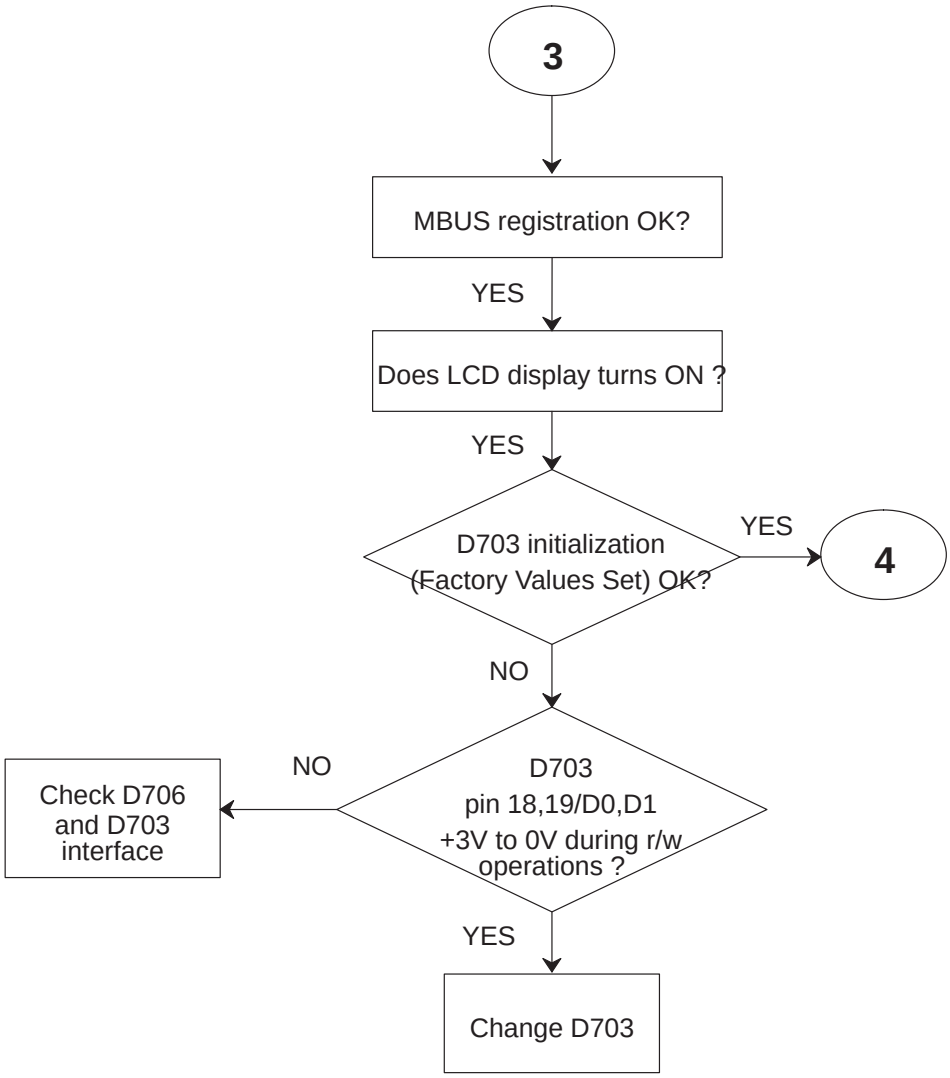
Troubleshooting Diagram; Flash Programming OK, part 1



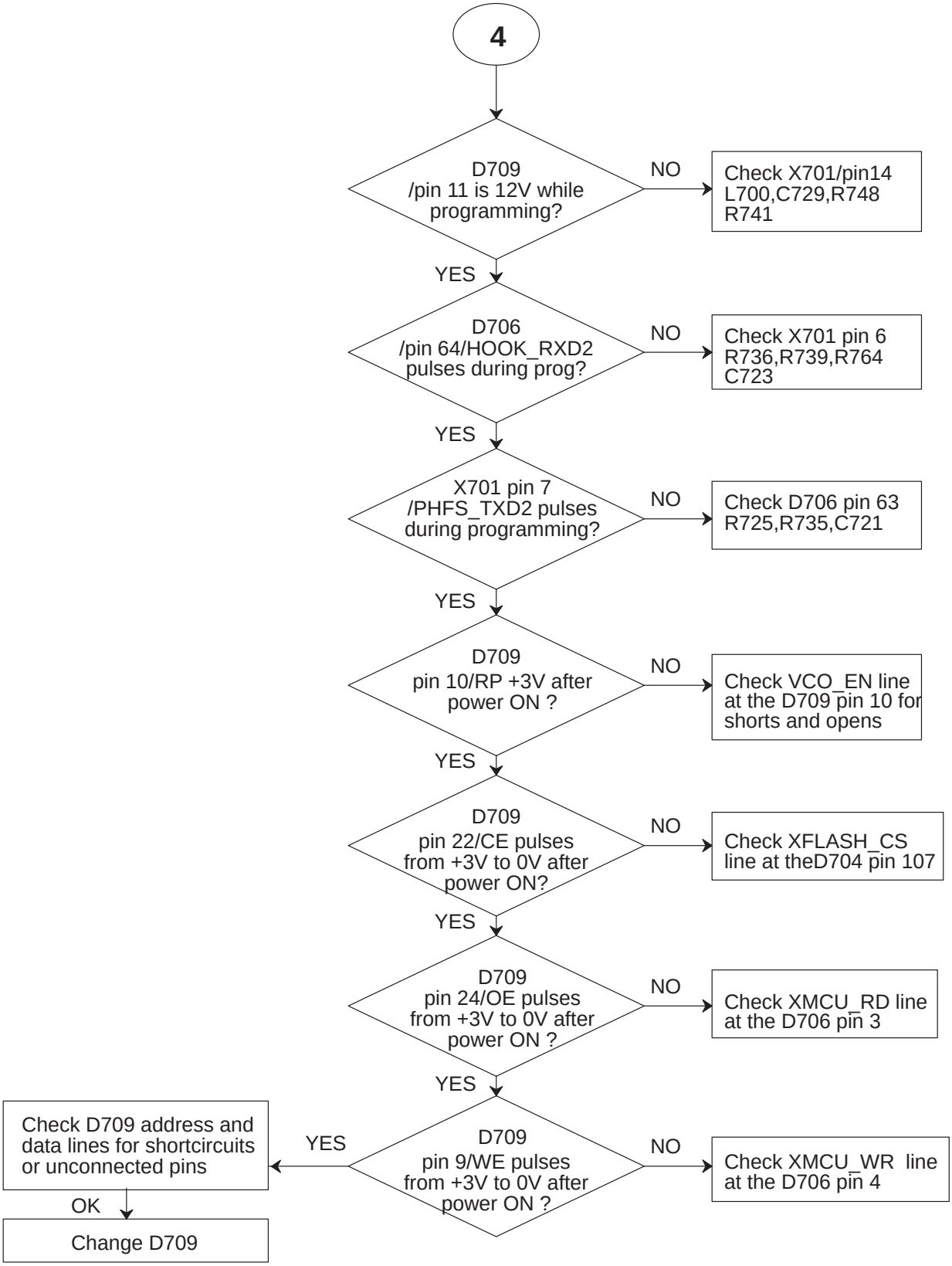
Troubleshooting Diagram; Flash Programming OK, part 2


2
D706 pin 10 XSYS_RESET +3V after power on?
NO
YES
15.36MHz at D706 pin 69 ?
NO
Check clock signal in N700 and D704
YES
Check D704 and D706 for short/open pins, if pins look OK change D704 if problem continues change D706
D706 pin8/MD2 and pin9/STBY are +3V ?
NO
Check these two pins for shorts and opens
YES
D706 pin 43/ XPWROFF has 0V to +3V pulses after power ON ?
NO
Change D706
YES
D706 pin 77 /IRQ0 +3V after power on?
NO
Check D704 and D706 for shorts and opens. If OK change D706
YES
D706 pin 11 /NMI 0V after power on?
NO
Check D704 and D706 for shorts and opens. If OK change D706
YES
D706 pin 4 /XMCU_WR +3V after pwr on?
NO
Check D706
YES
Check all soldered joints
The data and address signals must have a clear difference between low (0 V) and high (+3V)

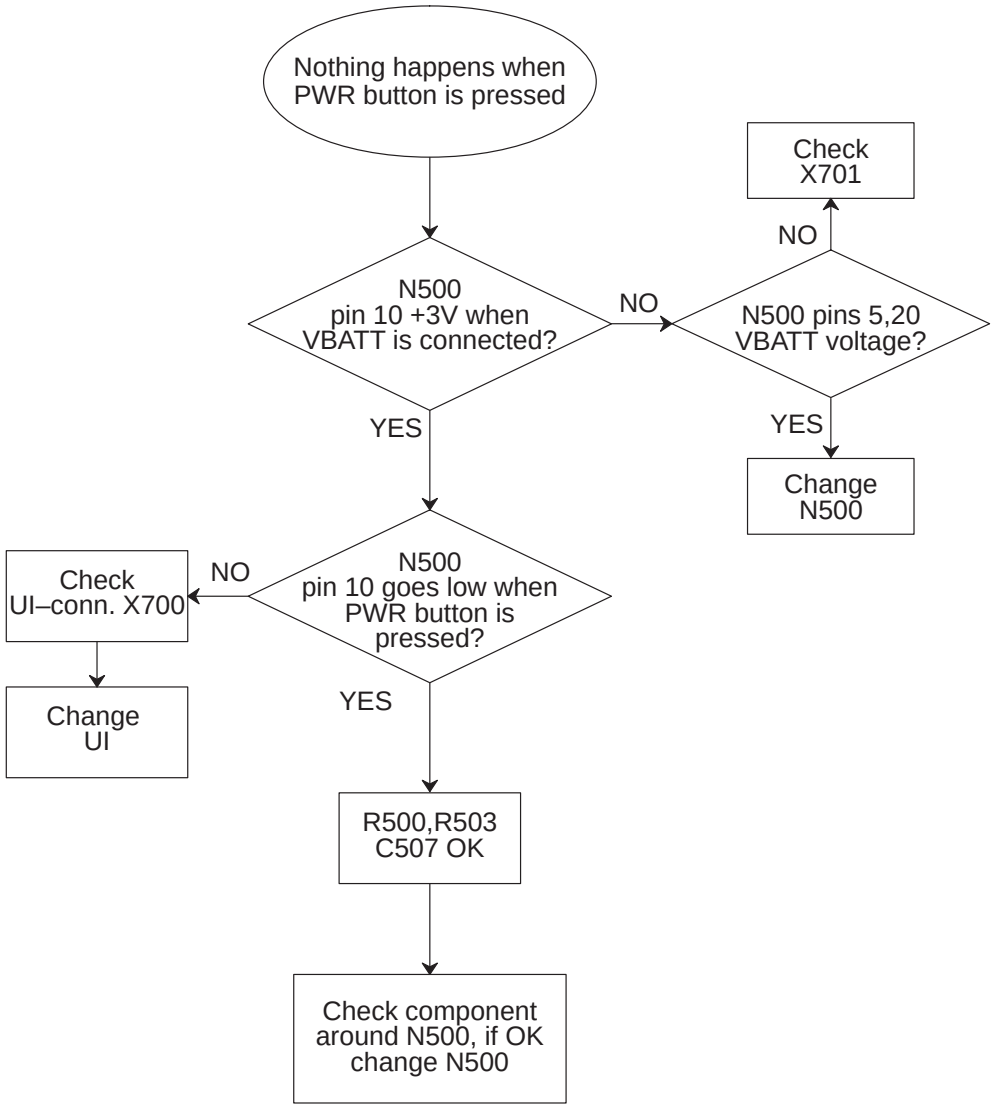
Troubleshooting Diagram; Flash Programming OK, part 3



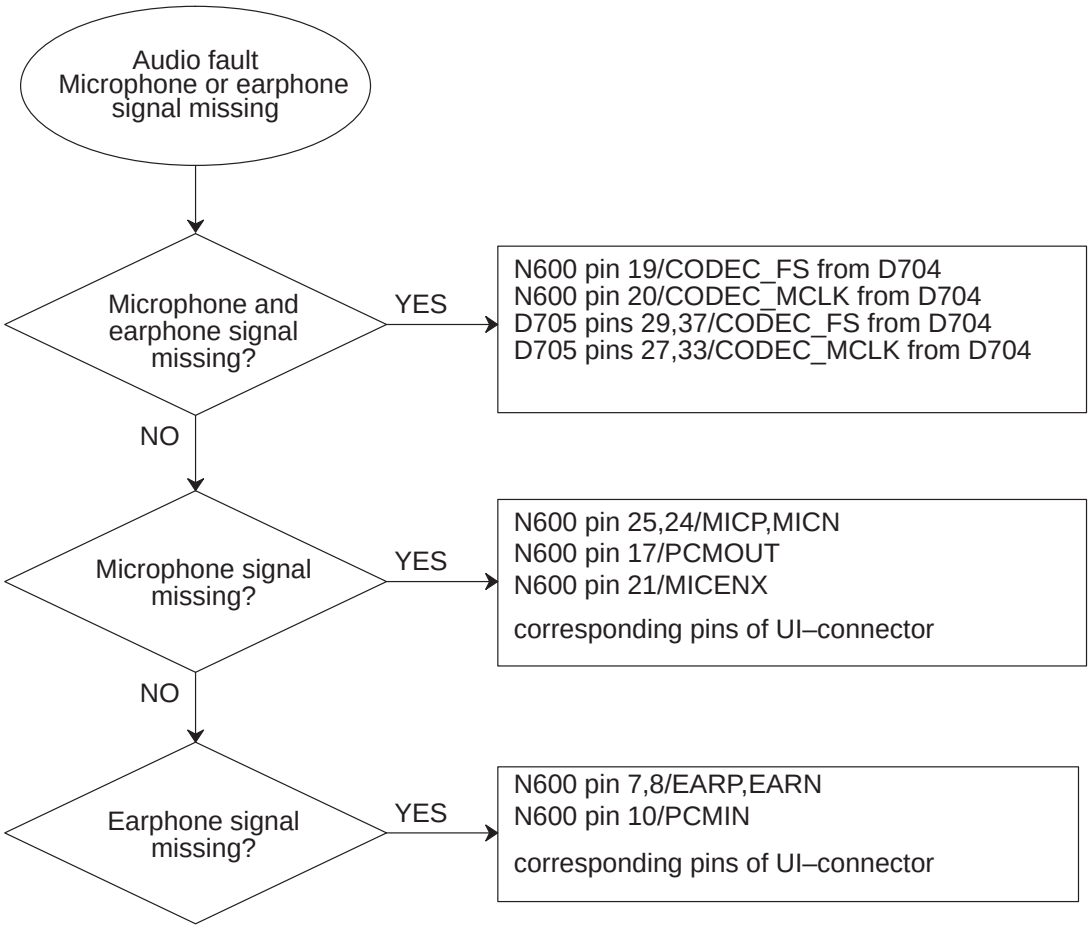
Troubleshooting Diagram; Flash Programming OK, part 4


4
D709 /pin 11 is 12V while programming?
NO
Check X701/pin14 L700,C729,R748 R741
YES
D706 /pin 64/HOOK_RXD2 pulses during prog?
NO
Check X701 pin 6 R736,R739,R764 C723
YES
X701 pin 7 /PHFS_TXD2 pulses during programming?
NO
Check D706 pin 63 R725,R735,C721
YES
D709 pin 10/RP +3V after power ON ?
NO
Check VCO_EN line at the D709 pin 10 for shorts and opens
YES
D709 pin 22/CE pulses from +3V to 0V after power ON?
NO
Check XFLASH_CS line at theD704 pin 107
YES
D709 pin 24/OE pulses from +3V to 0V after power ON ?
NO
Check XMCU_RD line at the D706 pin 3
YES
D709 pin 9/WE pulses from +3V to 0V after power ON ?
NO
Check XMCU_WR line at the D706 pin 4
YES
Check D709 address and data lines for shortcircuits or unconnected pins
OK
Change D709

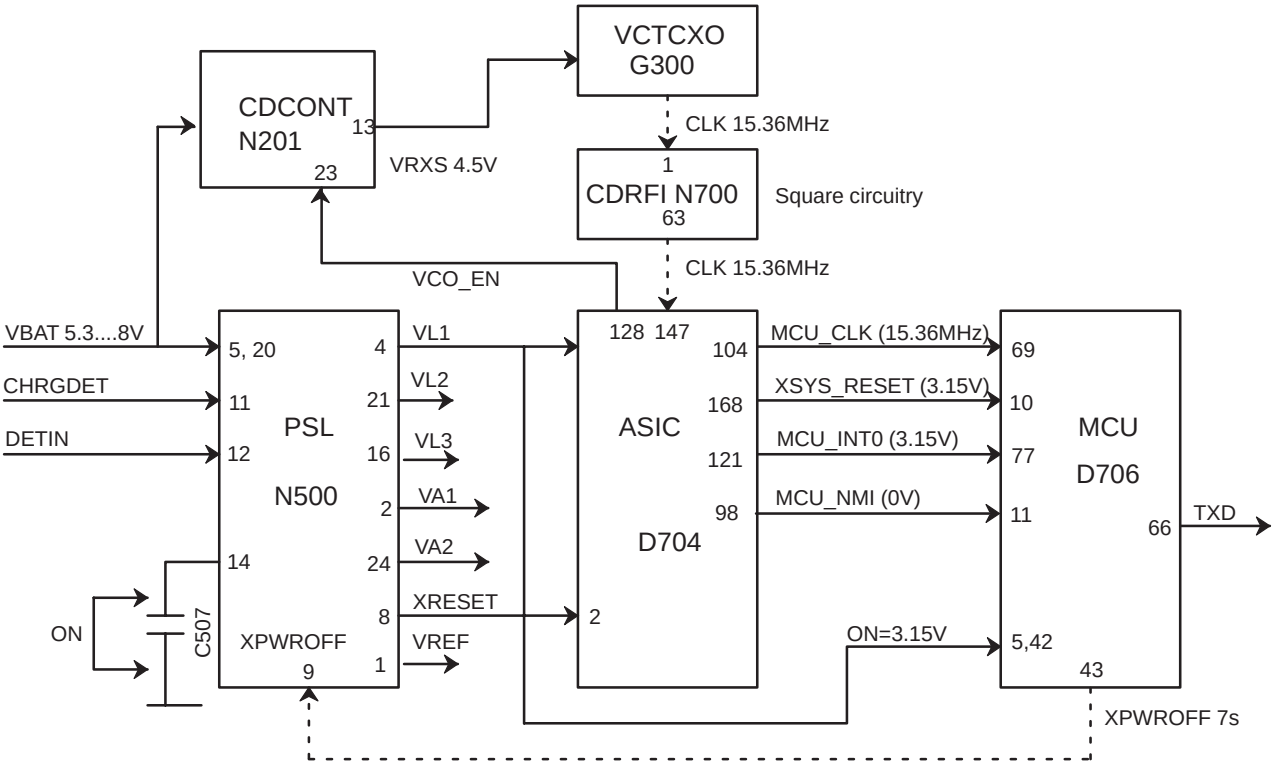
Troubleshooting Diagram; PWR Button Fault



Troubleshooting Diagram; Audio Fault



Power Up Sequence Diagram



PSL_+3V(N500)

- Output voltages must stay high at least 7seconds when power is switched on.
- If no; check C507.
- If it is OK; replace PSL_+3V(N500).
- If the XRESET line doesn't rise check DETIN. The voltage value at this pin should be between 1.46V and 1.72V.

ASIC(D704)

- When XRESET and CLK are supplied to the ASIC(D704) but MCUCLK or XSYS_RESET to the MCU(D706) are not supplied; replace ASIC(D704).

MCU(D706)

- If MCU_CLK and XSYS_RESET are supplied from ASIC(D704) but TXD line (MBUS) doesn't rise and solder joints of the MCU(D706) are good, check that MCU_INT0 is high (3.15V) and MCU_NMI is low (0V), if that is the case then replace MCU(D706).
- If TXD pin 66 of the MCU(D706) goes high but doesn't stay there at least 7seconds.

The power of the phone can be kept ON by:

- Connecting PSL +(N500) pin 14 to the ground.

Now it is possible to use service software for troubleshooting.

Repairing Instructions for Flash Faulty Units

1. When the phone doesn't start (power off after 7seconds and probably no MBUS connection) check following things:

- VBATT is connected to the PSL_+3V(N500)
- XRESET rises to 3.15V
- VL1 is 3.15V
- 32KHz clock is running.
- VRXS(4.5V) is connected to the VCTCXO and the crystal frequency is 15.36 MHz
- XSYS_RESET signal rises to 3.15V
- MCU_CLK signal is 15.36 MHz
- MCU_NMI line stays low(0V)
- MCU_IRQ0 line stays high(3.15V)

If all these happens, the MCU(D706) will supply power OFF pulses to the PSL_+3V(N500) and the power will stay on.

In faulty conditions, most likely MCU_IRQ0 stays low(0V), which means that interrupt is generated all the time.

In this case check data and address lines of ASIC(D704), MCU(D706) and memory circuits for short circuits or unconnected pins.

2. When FLASH programming is not succeed, check following things:

- System connector(X701) pins 6, 7, 14 are soldered and there are no short circuits.
- Flash programming voltage (VF=12V) is connected to the FLASH(D709) pin 11.
- The data and address lines of the FLASH(D709) are soldered.
- EEPROM(D703) should be OK because of the initialization (program parameters are loaded always when program is loading the first time).

3. When FACTORY SET is not succeed or the power is switched off after programming:

When power is switched on the program of the phone will go to maximum mode and if this doesn't work, there was a problem during the flash programming.

- Check solder joints of EEPROM(D703).
- Do FACTORY SET once again.

Calibrate Battery Voltage (VBATDET)= 6.0V

a) Check R505, R504

b) Check PSL_+3V(N500) pin 23

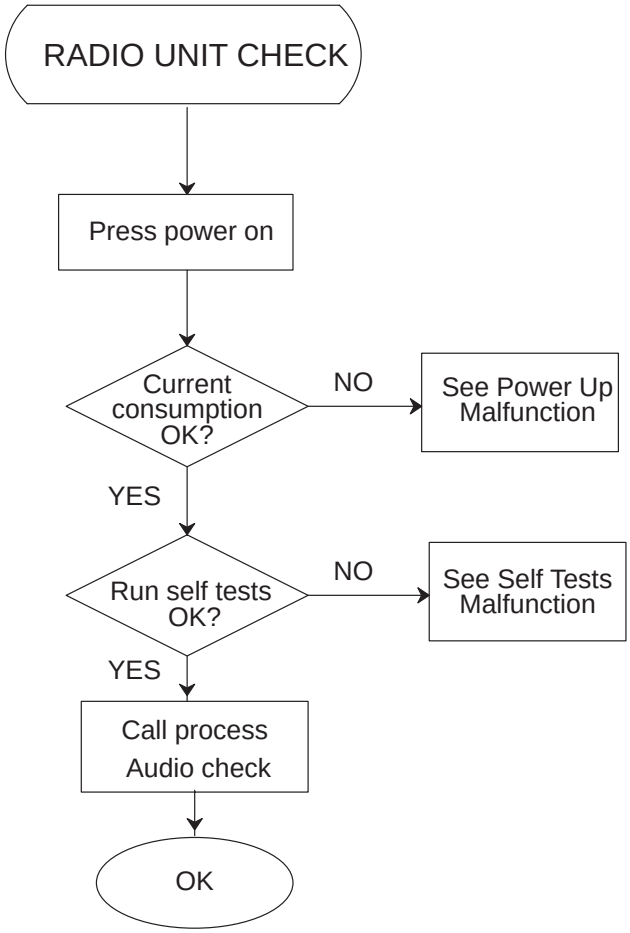
c) Check MCU(D706) pin 52

Calibrate Charge Voltage (VC)= 6.0V

a) Check R502, R501, R508

b) Check MCU(D706) pin 53

Troubleshooting Diagram; Power Up and MCU Self tests Malfunctions



Power Up Malfunction

Basically there are two different problems that could occur while powering up the phone. First, the current consumption is almost zero all the time. Probably the fault is at the power circuit PSL_+3V(N500). Check all PSL_+3V(N500) connections including VBATT line.

Second, the phone's current consumption is normal for 7seconds and goes to zero after that time. The reason for this is the watchdog.

1.0 Is MCU's clock running?

1 Check with oscilloscope if there is a clock signal at MCU(D706) pin 69. It should be a square wave signal, 50% duty cycle, 3Vpp and 15.36MHz. See Figure 1. Is the clock running?

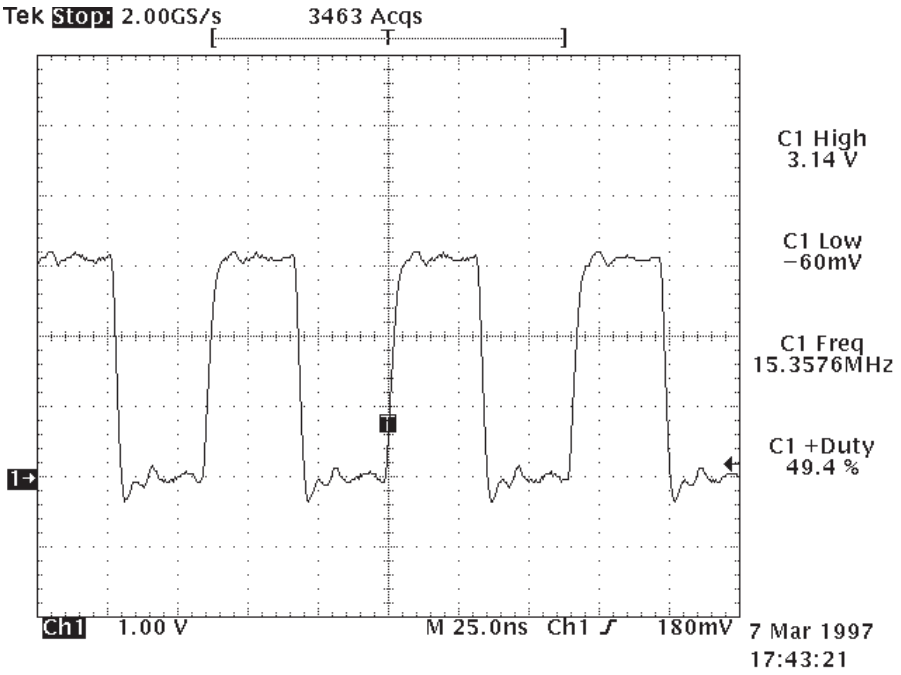


Figure 1

1 **YES!** Go to 2.0 / **NO!** Go to 1.1

1.1 Is VCTCXO running?

- Measure CDRFI(N700) pin 1. See Figure 2. Is there a 15.36MHz sine wave signal?

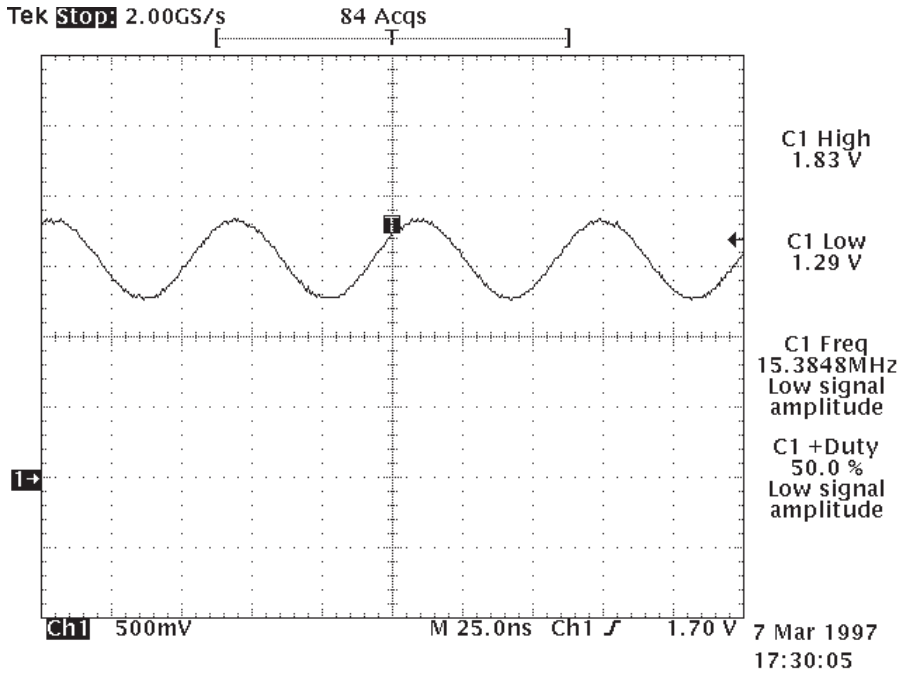


Figure 2

- **YES!** Go to 1.2 / **NO!** Go to 1.11

1.11 Check VCO_EN is high (3.15V) CDCONT(N201) pin 23.

1.12 Check VCTCXO(G300) waveform at CDCONT(N201) pin 35 looks like Figure 3. Also check that VRXS line is 4.5Vdc at CDCONT(N201) pin 13. If all these conditions are meet check solder joints for shorts and opens, if they are OK replace CDCONT(N201).

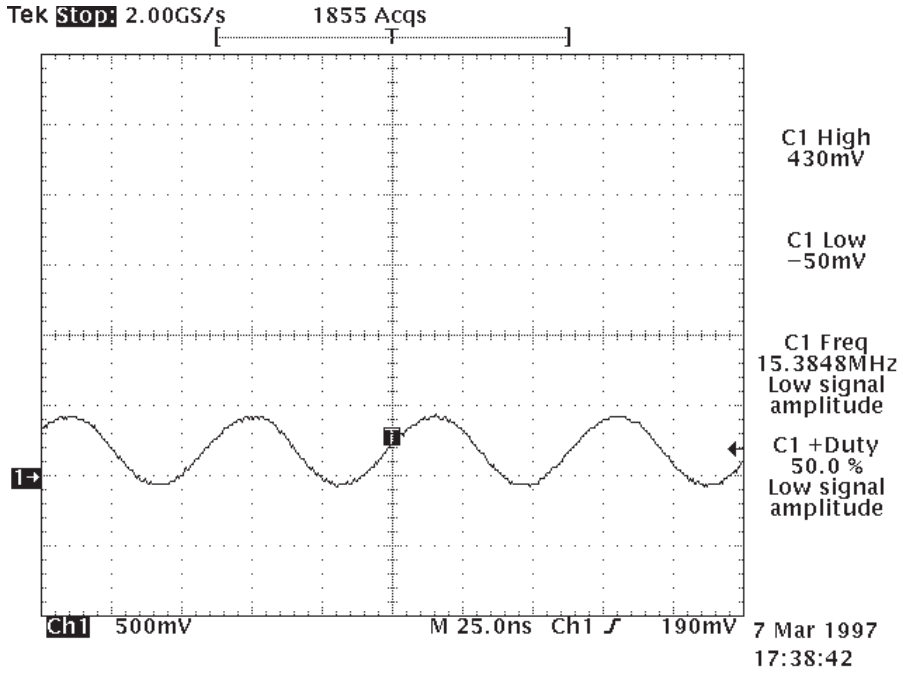


Figure 3

1.2 Check CDRFI(N700) pin 63. See Figure 4. Is there a 15.36MHz clock signal present?

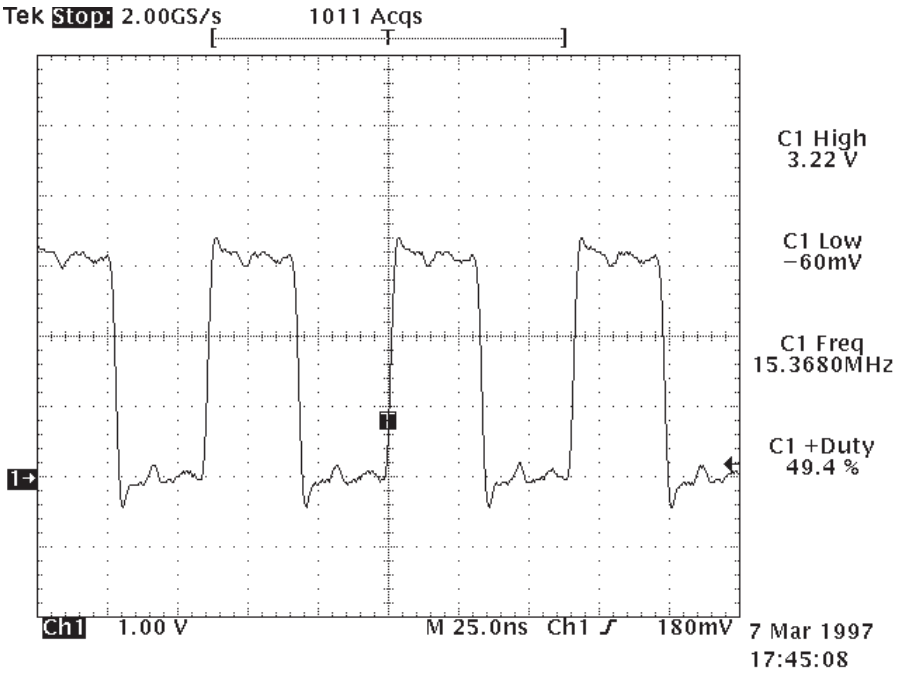


Figure 4

- **YES!** Go to 1.22 / **NO!** GO to 1.21

1.21 Check this signal solder joints, if OK replace CDRFI(N600).

1.22 Check connections between ASIC(D704) and MCU (D706), especially ASIC(D704) pin 104 and MCU(D706) pin 69. If no clock is present and connection looks OK replace ASIC(D704).

2.0 Are MCU's supply voltages OK?

1 Measure MCU(D706) supply voltages from pins 5 and 42 (nominal 3.15V V_{dc} ±0.15 V_{dc}). Are supply voltages right?

1 **YES!** Go to 3.0 / **NO!** Go to 2.1

2.1 Check PSL_+3V(N500) VL1(3.15V) pin 4

3.0 Is XSYS_RESET signal OK?

1 Check XSYS_RESET at MCU(D706) pin 10. While a high (about 3.15 V_{dc}) is ok, GO to 4.0. If zero then MCU(D706) is in reset, GO to 3.1.

3.1 Is XPWR_RESET signal from PSL_+3V(N500) OK?

- Check XPWR_RESET line from PSL_+3V(N500) pin 8. If it is high GO to 3.12, if zero GO to 3.11.

3.11 Check PSL_+3V pin 12. Voltage should be between 1.46V and 1.72V. if not check R500, R503 and VBATT voltage(5.3...8 V_{dc}) *NOTICE! Measure pin 10 from the PSL_+3V(N500) with oscilloscope. That is watchdog signal coming from*

MCU(D706). There should be rising edges time to time. If all these are OK and still XPWR_RESET is low replace the PSL_+3V(N500).

3.12 Check reset line for shorts and open between MCU(D706) and ASIC(D704), and between PSL_+3V(500) and ASIC(D704). If OK replace ASIC(D704).

4.0 Is 32KHz clock running?

1Check with oscilloscope if there is a 32.768KHz clock signal at ASIC(D704) pin 87. It should look like Figure 5.

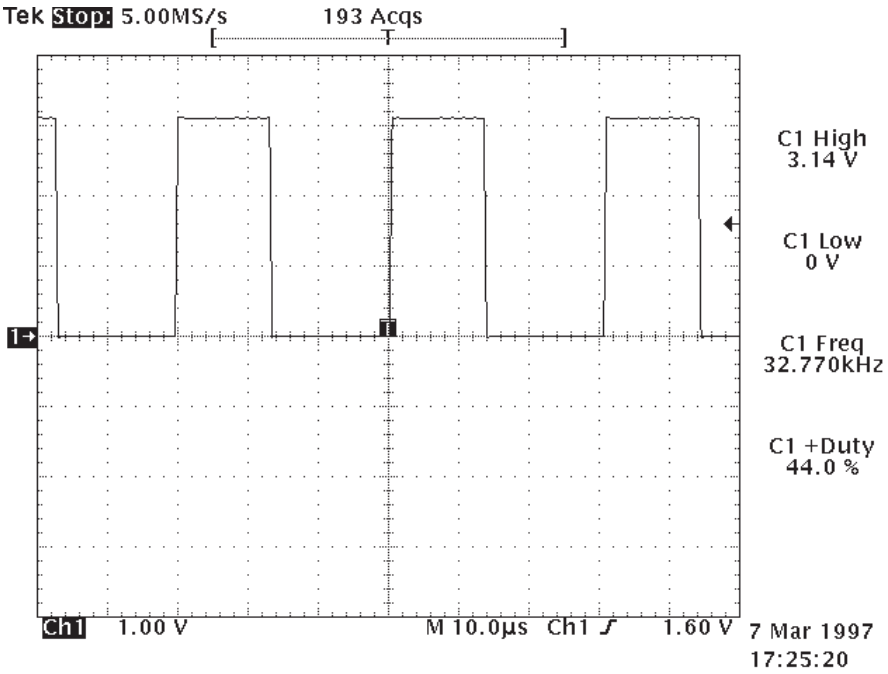


Figure 5

1**YES!** Go to 5.0 / **NO!** Go to 4.1

4.1 Check solder joints in ASIC(D704) pins 36, 37, 46, 125. Also check B700, C744, C745, R837, R757, If they are OK replace B700. If problem persists replace ASIC(D704).

5.0 Check all supply voltages!

1Measure all power supply voltage lines VL1(3.15V), VL2(3.15V), VL3(3.15V), VA2(3.15V) and VREF(3.15V).

1Are voltages right? **YES!** Go to 6.0. / **NO!** Read ahead!

1If any voltage is not the right one, check corresponding transistor. VL1 (V500), VL2(V502) and VL3(V501).

1Check also all major circuits supply voltages MCU(D706), ASIC(D704), PSL_+3V(N500), DSP(D705), CDRFI(N700) and CODEC(N600).

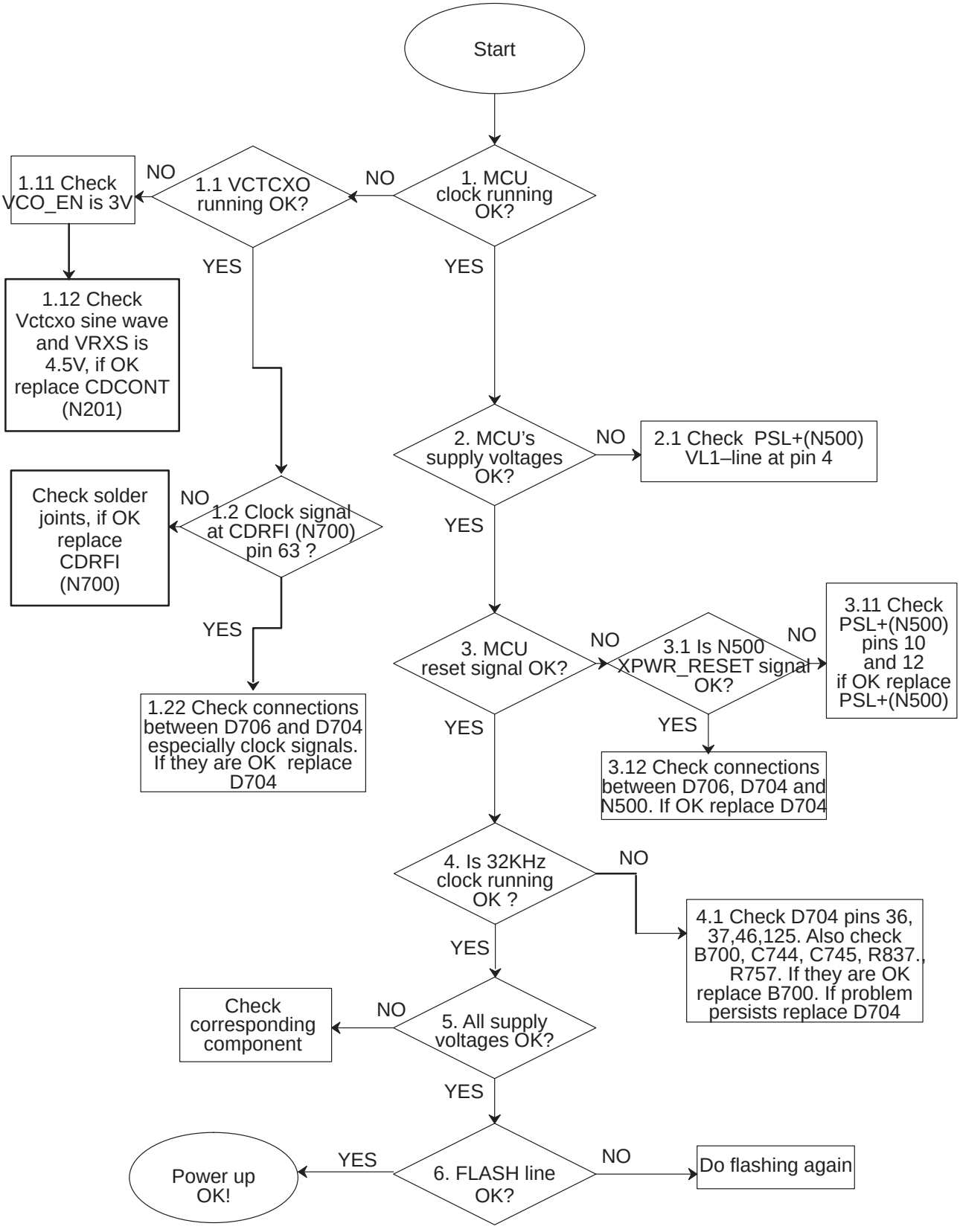
1This table might help to locate power pins on main circuits.

Circuit	Number	Pins	Supply voltage signal	
MCU	D706	5,42	VL1	
ASIC	D704	13,22,27,44,60,65,74,88,103	VL1	
	D704	109,117,132,146,151,161,176	VL1	
DSP	D705	8,11,36,39,49,64,76,87,90	VL2	
CDRFI	N700	32,33,60,62,2,6,8,19		VL3
CODEC	N600	2,3	VA2	
	N600	15	VL1	
FLASH	D709	30,31,11	VL1	
RAM	D700	28	VL1	
EEPROM	D703	7	VL1	

6.0 FLASH–line OK?
Power up function OK!

1**YES!** Power up function OK! / **NO!** Do flashing again.

Troubleshooting Diagram; Power Up Malfunction


Start
1. MCU clock running OK?
NO
1.1 VCTCXO running OK?
NO
1.11 Check VCO_EN is 3V
1.12 Check Vctcxo sine wave and VRXS is 4.5V, if OK replace CDCONT (N201)
YES
YES
2. MCU's supply voltages OK?
NO
2.1 Check PSL+(N500) VL1–line at pin 4
YES
1.2 Clock signal at CDRFI (N700) pin 63 ?
NO
Check solder joints, if OK replace CDRFI (N700)
YES
1.22 Check connections between D706 and D704 especially clock signals. If they are OK replace D704
3. MCU reset signal OK?
NO
3.1 Is N500 XPWR_RESET signal OK?
NO
3.11 Check PSL+(N500) pins 10 and 12 if OK replace PSL+(N500)
YES
YES
3.12 Check connections between D706, D704 and N500. If OK replace D704
4. Is 32KHz clock running OK ?
NO
4.1 Check D704 pins 36, 37,46,125. Also check B700, C744, C745, R837., R757. If they are OK replace B700. If problem persists replace D704
YES
5. All supply voltages OK?
NO
Check corresponding component
YES
6. FLASH line OK?
NO
Do flashing again
YES
Power up OK!

Important Information

This section contains information that might be helpful while troubleshooting an HD881 phone. However it is not needed to troubleshoot power up problems.

9.8304MHz clock

This clock is ”ON” when the phone is set to CDMA non–slotted mode and it is ”OFF” when the phone is set to AMPS mode. It is generated inside the CDCONT(N201) from the 15.36MHz. The waveform signal coming out from the CDCONT(N201) pin 40 should look like Figure 6.

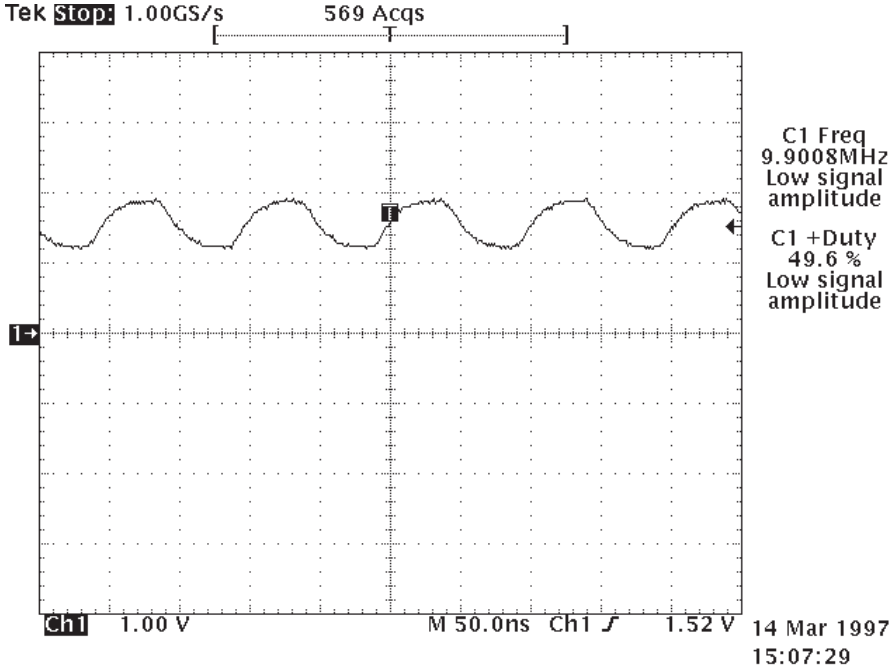


Figure 6

Then this signal is fed to the CDRFI(N700) squaring circuit on pin 3 to get the final 9.8304MHz clock signal that will go to the ASIC(D704). This clock should look like Figure 7.

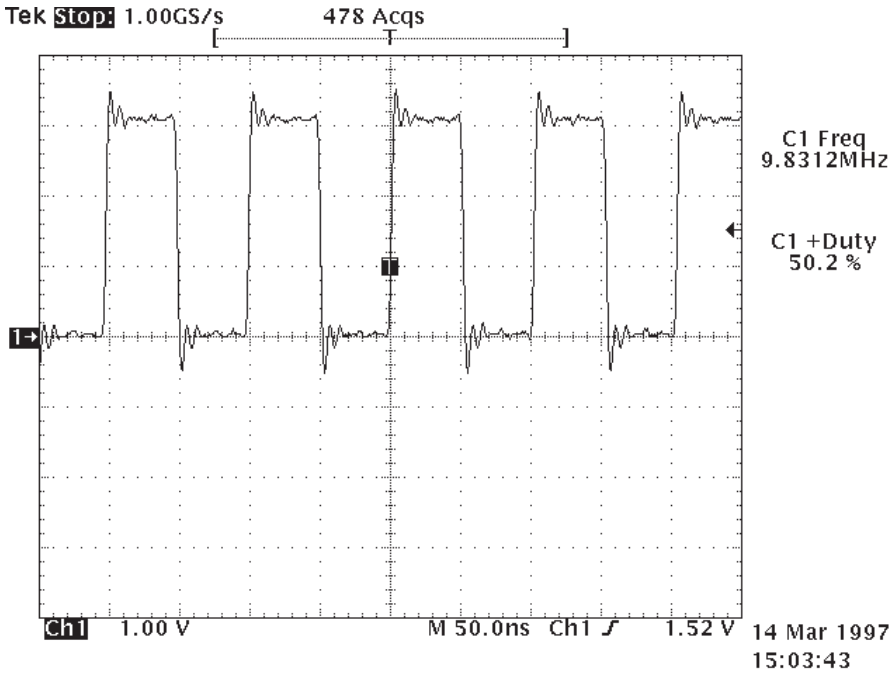

Tek Stop: 1.00GS/s
478 Acqs
C1 Freq
9.8312MHz
C1 +Duty
50.2 %
Ch1 1.00 V
M 50.0ns Ch1 ƒ 1.52 V
14 Mar 1997
15:03:43

Figure 7

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